

CBSE Class 10 Mathematics
Important Questions
Chapter 14
Statistics

1 Marks Questions

1. $\sum f_i = 15, \sum f_i x_i = 3p + 36$ and mean of any distribution is 3, then $p =$

- (a) 2
- (b) 3
- (c) 4
- (d) 5

Ans. (b) 3

2. For what value of x , the mode of the following data is 8:

4, 5, 6, 8, 5, 4, 8, 5, 6, x , 8

- (a) 5
- (b) 6
- (c) 8
- (d) 4

Ans. (c) 8

3. The numbers are arranged in ascending order. If their median is 25, then $x =$

5, 7, 10, 12, $2x-8$, $2x+10$, 35, 41, 42, 50

- (a) 10
- (b) 11
- (c) 12
- (d) 9

Ans. (c) 12

4. The median for the following frequency distribution is

X	6	7	5	2	10	9	3
F	9	12	8	13	11	14	7

(a) 6

(b) 5

(c) 4

(d) 7

Ans. (a) 6

5. In the formula $\bar{x} = a + h \left(\frac{\sum f_i u_i}{\sum f_i} \right)$, for finding the mean of grouped frequency distribution, $h =$

(a) $\frac{x_i + a}{h}$

(b) $h(x_i - a)$

(c) $\frac{x_i - a}{h}$

(d) $\frac{a - x_i}{h}$

Ans. (c) $\frac{x_i - a}{h}$

6. While computing mean of grouped data, we assume that the frequencies are

(a) evenly distributed over all the class

(b) centered at the class marks of the class

(c) centered the upper limits of the class

(d) centered the lower limits of the class

Ans. (b) centered at the class marks of the class

7. If $\sum f_i = 17, \sum f_i x_i = 4P + 63$ and mean = 7, then P =

(a) 12

(b) 13

(c) 14

(d) 15

Ans. (c) 14

8. If the value of mean and mode are respectively 30 and 15, then median =

(a) 22.5

(b) 24.5

(c) 25

(d) 26

Ans. (c) 25

9. The wickets taken by a bowler in 10 cricket matches are as follows

2, 6, 4, 5, 0, 2, 1, 3, 2, 3

Find the mode of the data.

(a) 1

(b) 4

(c) 2

(d) 3

Ans. (c) 2

10. Mean of the following data is

Class Interval	50-60	60-70	70-80	80-90	90-100
Frequency	8	6	12	11	13

- (a) 76
- (b) 77
- (c) 78
- (d) 80

Ans. (c) 78

11. Construction of a cumulative frequency table is useful in determining the

- (a) Mean
- (b) Median
- (c) Mode
- (d) all these conditions

Ans. (b) Median

12. In the following distribution of the heights of 60 students of a class

Height (inch)	150-155	155-160	160-165	165-170	170-175	175-180
No. of students	15	13	10	8	9	5

The sum of the lower limit of the modal class and upper limit of the median class is

- (a) 310
- (b) 315
- (c) 320

(d) 330

Ans. (b) 315

13. Choose the correct answer from the given four options in the formula

$$\bar{x} = a + \frac{\sum f_i x_i}{\sum f_i}$$

For finding the mean of grouped data d_i 's are deviations from a of

- (a) lower limits of the classes
- (b) Upper limits of the classes
- (c) Mid points of the classes
- (d) Frequencies of the class marks

Ans. (c) Mid points of the classes

14. If mean of the distribution is 7.5, then $p =$

X	3	5	7	9	11	13
F	6	8	15	P	8	4

- (a) 2
- (b) 4
- (c) 3
- (d) 6

Ans. (c) 3

15. A shoe shop in Agra had sold hundred pairs of shoes of particular brand in a certain day with the following distribution.

Size of the shoes	4	5	6	7	8	9	10
No. of pairs sold	1	4	3	20	45	25	2

Find mode of the destitution.

- (a) 20
- (b) 45
- (c) 1
- (d) 3

Ans. (b) 45

16. If the mode of a data is 45 and mean is 27, then median is

- (a) 30 (b) 27
- (c) 33 (d) None of these

No. of pairs sold 1 4 3 20 45 25 2

Find mode of the destitution.

- (a) 20 (b) 45 (c) 1 (d) 3

Ans. (c) 1

17. If x_i 's are the mid-points of the class intervals of grouped data, f_i 's are the corresponding frequency and \bar{x} is the mean, then $\sum (f_i x_i - \bar{x})$ is equal to

- (a) 0
- (b) -1
- (c) 1
- (d) 2

Ans. (a) 0

18. Mode of the following data is

Class Interval	0-20	20-40	40-60	60-80	80-100
Frequency	12	7	6	16	6

(a) 65

(b) 66

(c) 75

(d) 70

Ans. (d) 70

19. Median of the following data is

Class	0-500	500-1000	1000-1500	1500-2000	2000-2500
Frequency	4	6	10	5	3

(a) 1000

(b) 1100

(c) 1200

(d) 1150

Ans. (c) 1200

20. If the median of the distribution is 28.5, find the value of x.

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60	Total
Frequency	5	x	20	15	7	5	60

(a) 8

(b) 10

(c) 4

(d) 9

Ans. (a) 8

2 Marks Questions

1. The following data gives the number of boys of a particular age in a class of 40 students. Calculate the mean age of students:

Age (in years)	15	16	17	18	19	20
No. of student	3	8	10	10	5	4

Ans. We have

Age (in years) (x)	No. of students (f)	fx
15	3	45
16	8	128
17	10	170
18	10	180
19	5	95
20	4	80
	$\sum f = 40$	$\sum fx = 698$

$$\text{Mean } \bar{x} = \frac{\sum fx}{\sum f} = \frac{698}{40} = 17.45 \text{ years}$$

2. For the following grouped frequency distribution, find the mode.

Class	3-6	6-9	9-12	12-15	15-18	18-21	21-24
Frequency	2	5	10	23	21	12	3

Ans. Since the maximum frequency = 23 and it corresponds to the class 12-15

\therefore Modal class = 12-15

$$l = 12, n = 3, f_1 = 23, f_0 = 10, f_2 = 21$$

$$\begin{aligned} M_0 &= l + h \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \\ &= 12 + 3 \frac{23 - 10}{2 \times 23 - 10 - 21} \\ &= 12 + 3 \times \frac{13}{46 - 31} = 12 + \frac{39}{15} \\ &= 12 + \frac{13}{5} = 12 + 2.6 = 14.6 \end{aligned}$$

3. Construct the cumulative frequency distribution of the following distribution:

Class	12.5-17.5	17.5-22.5	22.5-27.5	27.5-32.5	32.5-37.5
Frequency	2	22	19	14	13

Ans. The required cumulative frequency distribution of the given distribution is given below:

Class	Frequency	Cumulative frequency
12.5-17.5	2	2
17.5-22.5	22	24
22.5-27.5	19	43
27.5-32.5	14	57
32.5-37.5	13	70

4. The median and mode of a distribution are 21.2 and 21.4 respectively, find its mean.

Ans. We know that Mean = Mode + $\frac{3}{2}$ (Median – Mode)

$$= 21.4 + \frac{3}{2}(21.2 - 21.4)$$
$$= 21.4 + \frac{3}{2}(-0.2)$$
$$= 21.4 - 0.3 = 21.1$$

5. The marks distribution of 30 students in a mathematics examination are given below

Class Interval	10-25	25-40	40-55	55-70	70-85	85-100
No. of students	2	3	7	6	0	6

Ans. Since the maximum frequency = 7 and it corresponds to the class 40-55.

The modal class = 40-55

Here, $l = 40, h = 15, f_1 = 7, f_0 = 3, f_2 = 6$

We know that mode M_0 is given by

$$M_0 = l + h \frac{f_1 - f_0}{2f_1 - f_0 - f_2} = 40 + \frac{15(7-3)}{2(7)-3-6}$$
$$= 40 + \frac{15 \times 4}{5} = 40 + 12 = 52$$

Thus, Mode marks = 52

6. Find the mode of this data.

Construct the cumulative frequency distribution of following distribution:

Marks	39.5-49.5	49.5-59.5	59.5-69.5	69.5-79.5	79.5-89.5	89.5-99.5
Students	5	10	20	30	20	15

Ans. The required cumulative frequency distribution of the given distribution is given below.

Marks	No. of Students	Cumulative Frequency
39.5-49.5	5	5
49.5-59.5	10	15
59.5-69.5	20	35
69.5-79.5	30	65
79.5-89.5	20	85
89.5-99.5	15	100
	$N = \sum f = 100$	

7. If the values of mean and mode are respectively 30 and 15, then median =

- (a) 22.5
- (b) 24.5
- (c) 25
- (d) 26

Ans. Median = Mode $+\frac{2}{3}$ (Mean - Mode)

$$= 15 + \frac{2}{3}(30 - 15)$$

$$= 15 + \frac{2}{3} \times 15$$

$$= 15 + 10 = 25$$

8. If the mean of the following data is 18.75. find the value of P.

x_i	10	15	P	25	30
f_i	5	10	7	8	2

Ans. We have

x_i	f_i	$x_i f_i$
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10	5	50
15	10	150
P	7	7P
25	8	200
30	2	60
	$N = \sum f_i = 32$	$\sum f_i x_i = 460 + 7P$

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = 18.75$$

$$18.75 = \frac{460 + 7P}{32}$$

$$\Rightarrow 460 + 7P = \frac{32 \times 1875}{100}$$

$$\Rightarrow 460 + 7P = 8 \times 75 = 600$$

$$\Rightarrow 7P = 600 - 460$$

$$\Rightarrow 7P = 140$$

$$\Rightarrow P = 20$$

9. Find the mean of the following data.

Classes	10-20	20-30	30-40	40-50	50-60
Frequency	5	8	13	15	9

Ans. We have

Classes	Mid-value x_i	Frequency f_i	$f_i x_i$
10-20	15	5	75
20-30	25	8	200
30-40	35	13	455
40-50	45	15	675
50-60	55	9	495
		$\sum f_i = 50$	$\sum f_i x_i = 1900$

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1900}{50} = 38$$

Hence, mean $\bar{x} = 38$

10. The following data gives the information observed life times (in hours) of 225 electrical components. Determine the modal life times of the components.

Life time (in hours)	0-20	20-40	40-60	60-80	80-100	100-200
Frequency	10	35	52	61	38	29

Ans. Since the maximum frequency = 61 and it corresponds to the class 60-80

∴ Modal class = 60-80

Here, $l = 60, h = 20, f_1 = 61, f_0 = 52, f_2 = 38$

We know that mode M_o is given by

$$\begin{aligned}
 M_o &= l + h \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \\
 &= 60 + 20 \frac{61 - 52}{2(61) - 52 - 38} \\
 &= 60 + 20 \frac{9}{122 - 90} \\
 &= 60 + \frac{20 \times 9}{32} \\
 &= 60 + \frac{45}{8} \\
 &= 60 + 5.625 \\
 &= 65.625 \text{ hours}
 \end{aligned}$$

Thus, modal life times = 65.625 hours

11. Construct the cumulative frequency distribution of the following distribution:

Class Interval	6.5-7.5	7.5-8.5	8.5-9.5	9.5-10.5	10.5-11.5	11.5-12.5	12.5-13.5
Frequency	5	12	25	48	32	6	1

Ans. The required cumulative frequency distribution of the given distribution is given below:

Class Interval	Frequency	Cumulative Frequency
6.5-7.5	5	5
7.5-8.5	12	17
8.5-9.5	25	42
9.5-10.5	48	90
10.5-11.5	32	122
11.5-12.5	6	128
12.5-13.5	1	129
	$N = \sum f = 129$	

12. Calculate the median from the following data:

Marks	0-10	10-30	30-60	60-80	80-100
No. of students	5	15	30	8	2

Ans. We have

Marks	No. of students (f)	C.F
0-10	5	5
10-30	15	20
30-60	30	50
60-80	8	58
80-100	2	60
	$N = \sum f = 60$	

Since $\frac{N}{2} = 30$ which lies in the class 30-60

\therefore Median class is 30-60

We know that median Me is given by

$$Me = l_1 + \frac{\frac{N}{2} - C}{f} \times h$$

Here, $l_1 = 30, h = 30, \frac{N}{2} = 30, C = 20, F = 30$

$$\therefore Me = 30 + \frac{30 - 20}{30} \times 30$$

$$= 30 + 10 = 40$$

Hence, median = 40

13. Find the mean of the following data:

Classes	0-10	10-20	20-30	30-40	40-50
Frequency	3	5	9	5	3

Ans. We have

Classes	Mid-value (x_i)	Frequency (f_i)	$x_i f_i$
0-10	5	3	15
10-20	15	5	75
20-30	25	9	225
30-40	35	5	175
40-50	45	3	135
		$\sum f_i = 25$	$\sum x_i f_i = 625$

$$\bar{x} = \frac{\sum x_i f_i}{\sum f_i} = \frac{625}{25} = 25$$

Now Mean

14. A survey conducted on 20 households in a locality by a group of students resulted in the following frequency table for the number of family members in a household. Find the mode.

Family size	1-3	3-5	5-7	7-9	9-11
No. of families	7	8	2	4	1

Ans. Since the maximum frequency = 8 and it corresponds to the class 3-5

Modal class = 3-5

Here, $l = 3, h = 2, f_1 = 8, f_0 = 7, f_2 = 2$

We know that mode M_o is given by

$$M_o = l + h \frac{f_1 - f_0}{2f_1 - f_0 - f_2}$$

$$= 3 + 2 \frac{(8 - 7)}{2(8) - 7 - 2}$$

$$= 3 + 2 \frac{(1)}{7} = 3 + \frac{2}{7}$$

$$= 3 + 0.2857 = 3.286 \text{ nearly}$$

15. Construct the cumulative frequency distribution of the following distribution:

Class Interval	0-10	10-20	20-30	30-40	40-50	50-60
Frequency	5	3	10	6	4	2

Ans. The required cumulative frequency distribution of the given distribution is given below:

Class Interval	Frequency (f)	Cumulative frequency
0-10	5	5
10-20	3	8
20-30	10	18
30-40	6	24
40-50	4	28
50-60	2	30
Total	N= 30	

16. If the values of mean and median are 26.4 and 27.2, what will be the value of mode?

Ans. We know that

$$\text{Mode} = 3 \text{ median} - 2 \text{ mean}$$

$$= 3(27.2) - 2(26.4)$$

$$= 81.6 - 52.8 = 28.8$$

$$\text{Mode} = 28.8$$

17. The marks obtained by 30 students of class X of a certain school in a Mathematics paper consisting of 100 marks are presented in table below. Find the mean of the marks obtained by the students.

Marks obtained (x_i)	10	20	36	40	50	56	60	70	72	80	88	92	98
students (f_i)	1	1	3	4	3	2	4	4	1	1	2	3	1

Ans.

Marks obtained (x_i)	No. of students (f_i)	$f_i x_i$
10	1	10
20	1	20
36	3	108
40	4	160
50	3	150
56	2	112
60	4	240
70	4	280
72	1	72
80	1	80
88	2	176
92	3	276
95	1	95
	$\sum f_i = 30$	$\sum f_i x_i = 1779$

$$\text{Mean } \bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1779}{30} = 59.3$$

$$\text{Thus, mean } \bar{x} = 59.3$$

18. A student noted the numbers of cars passing through a spot on a road for 100 periods each of 3 minutes and summarized in the table given below. Find the mode of the data.

No. of cars	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	7	14	13	12	20	11	15	8

Ans. Since the maximum frequency = 20

And it corresponds to the class 40-50

Modal class = 40-50

Here, $l = 40, h = 10, f_1 = 20, f_0 = 12, f_2 = 11$

We know that mode M_0 is given by

$$M_0 = l + h \frac{f_1 - f_0}{2f_1 - f_0 - f_2}$$

$$= 40 + 10 \left(\frac{20 - 12}{2(20) - 12 - 11} \right)$$

$$= 40 + \frac{80}{17} = 40 + 4.705$$

$$= 44.705 = 44.7$$

19. Construct the cumulative frequency distribution of the following distribution:

consumption (units)	65-85	85-105	105-125	125-145	145-165	165-185
Consumers (f_i)	4	5	12	20	14	8

Ans. The required accumulative frequency distribution of the given distribution is given below.

Monthly consumption (in units)	No. of consumes (f_i)	Cumulative frequency (cf)
65-85	4	4
85-105	5	9
105-125	13	22
125-145	20	42
145-165	14	56
165-185	8	64
	N = 64	

20. If the values of mean and median are 53.6 and 55.81, what will be the value of mode?

Ans. We know that

$$\text{Mode} = 3 \text{ Median} - 2 \text{ mean}$$

$$\text{Mean} = \frac{3(55.81) - 2(53.6)}{3 - 2}$$

$$= 167.43 - 107.2 = 60.23$$

3 Marks Questions

1. The following table shows the weekly wages drawn by number of workers in a factory, find the median of the following data.

Weekly wages (in Rs.)	0-100	100-200	200-300	300-400	400-500
No. of workers	40	39	34	30	45

Ans. We have

Weekly wages (in Rs.)	No. of workers (f)	C.F
0-100	40	40
100-200	39	79
200-300	34	113
300-400	30	143
400-500	45	188
	$N = \sum f = 188$	

Now $\frac{N}{2} = \frac{188}{2} = 94$ and this is in 200-300 class.

∴ Median class = 200-300

Here, $l_1 = 200, c = 79, h = 100, f = 34, \frac{N}{2} = 94$

We know that $Me = l_1 + \frac{\frac{N}{2} - c}{f} \times h$

$$\begin{aligned}
&= 200 + \frac{94 - 79}{34} \times 100 \\
&= 200 + \frac{1500}{34} \\
&= 200 + \frac{750}{17} \Rightarrow 200 + 14.12 \\
&= 244.12
\end{aligned}$$

2. Find the median of the following data:

Marks	Frequency
Less than 10	0
Less than 30	10
Less than 50	25
Less than 70	43
Less than 90	65
Less than 110	87
Less than 130	96
Less than 150	100

Ans. First of all we shall change cumulating series into simple series.

We have

X	F	C.F
0-10	0	0
10-30	10	10
30-50	15	25
50-70	18	43
70-90	22	65
90-110	22	87
110-130	9	96
130-150	4	100
	$N = \sum f = 100$	

Now $\frac{N}{2} = \frac{100}{2} = 50$, which lies in 70-90 class

\therefore Median class = 70-90

Here, $l_1 = 70, c = 43, h = 20, f = 22, N = 100$

$$\text{We know that Median, Me} = l_1 + \frac{\frac{N}{2} - C}{f} \times h$$

$$\begin{aligned} &= 70 + \frac{20}{22}(50 - 43) \\ &= 70 + \frac{20 \times 7}{22} = 70 + \frac{70}{11} \\ &= 70 + 6.36 \\ &= 76.36 \end{aligned}$$

3. Find the median of the following data.

Wages (in rupees)	No. of workers
More than 150	Nil
More than 140	12
More than 130	27
More than 120	60
More than 110	105
More than 100	124
More than 90	141
More than 80	150

Ans. First of all we shall find simple frequencies.

Wages (in Rupees) (X)	No. of workers (F)	C.F
80-90	9	9
90-100	17	26
100-110	19	45
110-120	45	90
120-130	33	123
130-140	15	138
140-150	2	150
	$N = \sum f = 150$	

Now $\frac{N}{2} = \frac{150}{2} = 75$, which lies in 110-120 class

∴ Median class = 110-120

Here, $l_1 = 110, c, 45, h = 10, f = 45, N = 150$

$$\text{We know that Me} = l_1 + \frac{\frac{M}{2} - C}{F} \times h$$

$$= 110 + \frac{10}{45}(75 - 45)$$

$$= 110 + \frac{10 \times 30}{45} = 110 + \frac{20}{3}$$

$$= 110 + 6.67 = 116.67$$

4. Draw a less than Ogive for the following frequency distribution.

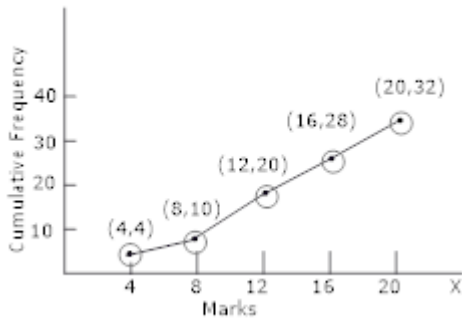
Marks	No. of students
0-4	4
4-8	6
8-12	10
12-16	8
16-20	4

Ans. We have

Marks	Frequency (F)	C.F
0-4	4	4
4-8	6	10
8-12	10	20
12-16	8	28
16-20	4	32
	$\sum f = 32$	

Upper class limits	4	8	12	16	20
Cumulative frequency	4	10	20	28	32
Plot the points	(4,4)	(8,10)	(12,20)	(16,28)	(20,32)

Join these points by a free hand curve. We get the required Ogive which is as follows:



5. Find the mean age in years from the frequency distribution given below:

Age (in yrs)	15-19	20-24	25-29	30-34	35-39	40-44	45-49	Total
Frequency	3	12	21	15	5	4	2	3

Ans. We have

Class-Interval	Mid value	f_i	$u_i = \frac{x_i - a}{h} = \frac{x_i - 32}{5}$	$f_i u_i$
15-19	17	3	-3	-9
20-24	22	13	-2	-26
25-29	27	21	-1	-21
30-34	32	15	0	0
35-39	37	5	1	5
40-44	42	4	2	8
45-49	47	2	3	6
Total		$\sum f_i = 63$		$\sum f_i u_i = -37$

Let assumed mean 'a' = 32, Here h = 5

$$\bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h$$

We know that Mean

$$\begin{aligned}
 &= 32 - \frac{37 \times 5}{63} \\
 &= 32 - \frac{185}{63} \\
 &= 32 - 2.94(\text{nearly}) \\
 &= 29.06 \text{ years}
 \end{aligned}$$

6. Find the median of the following frequency distribution:

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Wages (in Rs.)	200-300	300-400	400-500	500-600	600-700
No. of Laborers	3	5	20	10	6

Ans. We have

Wages (in Rs.)	No. of laborers (f)	C.F
200-300	3	3
300-400	5	8
400-500	20	28
500-600	10	38
600-700	6	44
	$N = \sum f = 44$	

Now $\frac{N}{2} = \frac{44}{2} = 22$ and this lies in 400-500 class.

\therefore Median class = 400-500

Here, $l_1 = 400, C = 8, h = 100, f = 20, N = 44$

We know that $Me = l_1 + \frac{\frac{N}{2} - C}{F} \times h$

$$\begin{aligned}
 &= 400 + \frac{22-8}{20} \times 100 \\
 &= 400 + \frac{14 \times 100}{20} \\
 &= 400 + 70 \\
 &= 470
 \end{aligned}$$

9. Thirty women were examined in a hospital by a doctor and the number of heart beats per minute were recorded and summarized as follows. Find the mean heart beats per minute for these women choosing a suitable method.

Number of heart beats per minute	No. of women
65-68	2
68-71	4
71-74	3
74-77	8
77-80	7
80-83	4
83-86	2

Ans. Let assumed mean 'a' = 75.5. We have

No. of heart beats per minute	No. of women (f_i)	Class Mark i.e mid value (x_i)	$u_i = \frac{x_i - a}{h}$	$f_i u_i$
65-68	2	66.5	-3	-6
68-71	4	69.5	-2	-8
71-74	3	72.5	-1	-3
74-77	8	75.5=a	0	0
77-80	7	78.5	1	7
80-83	4	81.5	2	8
83-86	2	84.5	3	6
	$\sum f_i = 30$			$\sum f_i u_i = 4$

We know that

$$\bar{x} = a + \frac{\sum f_i x_i}{\sum f_i} \times h \quad \text{[By step Deviation Method]}$$

$$\begin{aligned} &= 75.5 + \frac{4}{30} \times 3 \\ &= 75.5 + 0.4 \\ &= 75.9 \end{aligned}$$

11. Following table shows the daily pocket allowances given to the children of a multi-story building. The mean of the pocket allowances is Rs. 18. Find out the missing frequency.

Class Interval	11-13	13-15	15-17	17-19	19-21	21-23	23-25
Frequency	3	6	9	13	?	5	4

Ans. Let the missing frequency = f, we have

Class interval	f_i	Mid-value	$u_i = \frac{x_i - a}{h} = \frac{x_i - 18}{2}$	$f_i u_i$
11-13	3	12	-3	-9
13-15	6	14	-2	-12
15-17	9	16	-1	-9
17-19	13	18	0	0
19-21	f	20	1	F
21-32	5	22	2	10
23-25	4	24	3	12
	$\sum f_i = 40 + f$			$\sum f_i u_i = f - 8$

Let assumed mean a = 18, Here h = 2

$$\bar{x} = a + \frac{\sum fix_i}{\sum f_i} \times h$$

We know that mean

$$\Rightarrow 18 = 18 + \frac{(f-8)}{40+f} \times 2$$

$$\Rightarrow 0 = f - 8$$

$$\Rightarrow f = 8$$

Hence, missing frequency = 8

12. A survey regarding the heights (in cm) of 51 girls of Class X of a school was conducted and the following data was obtained. Find the median height.

Height (in cm)	No. of girls
Less than 140	4
Less than 145	11
Less than 150	29
Less than 155	40
Less than 160	46
Less than 165	51

Ans. We have,

Class Intervals	Frequency (f)	C.F
Below 140	4	4
140-145	7	11
145-150	18	29
150-155	11	40
155-160	6	46
160-165	5	51
	$N = \sum f = 51$	

Here, $\frac{N}{2} = \frac{51}{2} = 25.5$ which is in the class 145-150

Here, $l_1 = 145, h = 5, N = 51, C = 11, F = 18$

$$\therefore \text{Median} = l_1 + \frac{\frac{N}{2} - C}{f} \times h$$

$$= 145 + \frac{25.5 - 11}{18} \times 5$$

$$= 145 + \frac{72.5}{18} \Rightarrow 149.03$$

∴ Median height of the girls = 149.03

13. Calculate the mean for the following distribution:

Class Interval	0-4	4-8	8-12	12-16	16-20	20-24	24-28	28-32
Frequency	2	5	8	16	14	10	8	3

Ans. By stepdeviation Method

Let assumed mean $a = 14$

Class interval	Mid-value (x_i)	Frequency (f_i)	Deviation $d_i = x_i - a$	Product ($f_i d_i$)
0-4	2	2	-12	-24
4-8	6	5	-8	-40
8-12	10	8	-4	-32
12-16	14	16	0	0
16-20	18	14	4	56
20-24	22	10	8	80
24-28	26	8	12	96
28-32	30	3	16	48
Total		$\sum f_i = 66$		$\sum f_i d_i = 184$

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

We know that Mean

$$\begin{aligned}
 &= 14 + \frac{184}{66} \\
 &= 14 + 2.866 \\
 &= 16.866
 \end{aligned}$$

14. The percentage of marks obtained by 100 students in an examination are given below:

Marks	30-35	35-40	40-45	45-50	50-55	55-60	60-65
Frequency	14	16	18	23	18	8	3

Determine the median percentage of marks.

Ans.

Class interval	Mid-value (x_i)	Frequency (f_i)	Deviation $d_i = x_i - a$	Product ($f_i d_i$)
0-4	2	2	-12	-24
4-8	6	5	-8	-40
8-12	10	8	-4	-32
12-16	14	16	0	0
16-20	18	14	4	56
20-24	22	10	8	80
24-28	26	8	12	96
28-32	30	3	16	48
Total		$\sum f_i = 66$		$\sum f_i d_i = 184$

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

We know that Mean

$$= 14 + \frac{184}{66}$$

$$= 14 + 2.866$$

$$= 16.866$$

Therefore $\frac{n}{2} = 50$, which lies in the class 45-50

l_1 (The lower limit of the median class) = 45

c (The cumulative frequency of the class preceding the median class) = 48

f (The frequency of the Median class) = 23

h (The class size) = 5

$$= l_1 + \left[\frac{\frac{n}{2} - c}{f} \right] h$$

Median

$$= 45 + \left(\frac{50 - 48}{23} \right) \times 5$$

$$= 45 + \frac{10}{23} = 45.4$$

So, the median percentage of marks is 45.4

16. The A.M of the following frequency distribution is 53. Find the value of P.

Classes	0-20	20-40	40-60	60-80	80-100
Frequency	12	15	32	P	13

Ans. We have

Class Interval	Mid-value (x_i)	Frequency (f_i)	$f_i x_i$
0-20	10	12	120
20-40	30	15	450
40-60	50	32	1600
60-80	70	P	70P
80-100	90	13	1170
		$\sum f_i = 72 + P$	$\sum f_i x_i = 3340 + 70P$

Since Mean $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$

$$\Rightarrow 53 = \frac{3340 + 70P}{72 + P}$$

$$\Rightarrow 3340 + 70P = 3816 + 53P$$

$$\Rightarrow 17P = 3816 - 3340$$

$$\Rightarrow P = \frac{476}{17}$$

$$\Rightarrow P = 28$$

Thus, P = 28

4 Marks Questions

1. In the following distribution, locate the median mean and mode.

Monthly consumption of electricity	65-85	85-105	105-125	125-145	145-165	165-185	185-205
No. of consumers	4	5	13	20	14	7	4

2. **Ans.**

Monthly consumption of electricity	No. of consumers	C.F	Class Mark (X)	FX
65-85	4	4	75	300
85-105	5	9	95	475
105-125	13	22	115	1495
125-145	20	42	135	2700
145-165	14	56	155	2670
165-185	8	64	175	1400
185-205	4	68	195	780
	$N = \sum f = 63$			$\sum fx = 9320$

3. Now $\frac{N}{2} = \frac{68}{2} = 34$ and this is in 125-145 class

Median class = 125-145
 $l_1 = 125, c = 22, h = 20, f = 20, \frac{N}{2} = 34$

Here,

$$Me = l_1 + \frac{\frac{N}{2} - c}{f} \times h = 125 + \frac{34 - 22}{20} \times 20$$

~~We know that~~

Hence, Median = ~~137~~
 $(x) = \frac{\sum fx}{\sum f} = \frac{9320}{68} = 137.05$

Again Mean

For mode, since the maximum frequency is 20 and this corresponds to the class 125-145 $l = 125, h = 20, f_1 = 20, f_0 = 13, f_2 = 14$

Here,

$$M_0 = l + h \frac{f_1 - f_0}{2f_1 - f_0 - f_2}$$

$$= 125 + 20 \left(\frac{20 - 13}{2(20) - 13 - 14} \right)$$

$$= 125 + 20 \left(\frac{7}{13} \right) = 125 + \frac{140}{13}$$

$$= 125 + 10.76 = 135.76$$

Thus, Median = 137, Mean = 137.05 and Mode = 135.76
 The three measures are approximately the same in the class.

2. Find the mean, mode and median for the following data:

Classes	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	5	8	15	20	14	8	5

Ans. We have

Classes	Mid-value (x_i)	Frequency (f_i)	$x_i = \frac{x-a}{10}$	$f_i x_i$	C.f
0-10	5	5	-3	-15	5
10-20	15	8	-2	-16	13
20-30	25	15	-1	-15	28
30-40	35	20	0	0	48
40-50	45	14	1	14	62
50-60	55	8	2	16	70
60-70	65	5	3	15	75
		$\sum f_i = 75$		$\sum f_i x_i = -1$	

Let assumed mean $a = 35$, $h =$ length of class interval $= 10$

$$x = a + \frac{\sum f_i x_i}{\sum f_i} \times h = 35 - \frac{1}{75} \times 10$$

Mean \bar{x}
 $= 35 - \frac{1}{15}$

$$= 35 - 0.13$$

$$= 34.87$$

Since, Maximum frequency = 20

Modal class = 30-40

$$l + h \frac{f_1 - f_0}{2f_1 - f_0 - f_2}$$

Mode = $\left(\frac{20 - 15}{40 - 50 - 14} \right)$

$$= 30 + \frac{50}{11}$$

$$= 30 + 4.55$$

$$= 34.55$$

Hence, mode = 34.55

$$\frac{2}{2} = \frac{2}{2} = 37.5$$

Since, 37.5 , which lies in the class 30-40

i.e., Median class = 30-40

$$l_1 = 30, \frac{N}{2} = 37.5, C = 28, f = 20, h = 10$$

$$l_1 + \frac{\frac{N}{2} - C \times h}{f}$$

Median $\bar{x} = \frac{28}{20} \times 10$

$$= 30 + \frac{9.5}{2}$$

$$= 30 + 4.75$$

$$= 34.75$$

Hence, Median = 34.75

3. Find the mean, mode and median for the following data:

Classes	10-20	20-30	30-40	40-50	50-60	60-70	70-80
Frequency	4	8	10	12	10	4	2

Ans. We have

Classes	Mid value (x_i)	f_i	$\frac{x_i - a}{h} = u_i$	$f_i u_i$	c.f
10-20	15	4	-3	-12	4
20-30	25	8	-2	-16	12
30-40	35	10	-1	-10	22
40-50	45	12	0	0	34
50-60	55	10	1	10	44
60-70	65	4	2	8	48
70-80	75	2	3	6	50
		$N = \sum f_i = 50$		$\sum f_i u_i = -14$	

Let assumed mean $a = 45$, Here $h = 10$

$$(\bar{x}) = a + \frac{\sum f_i x_i}{\sum f_i} \times h$$

We know that mean

$$= 45 - \frac{14}{50} \times 10$$

$$= 45 - \frac{14}{5}$$

$$= 45 - 2.8$$

$$\text{Mean } (\bar{x}) = 42.2$$

Since maximum frequency = 12

\therefore Modal class = 40-50

Here, $l = 40, f_1 = 12, f_0 = 10, h = 10, f_2 = 10$

$$= l + \frac{f_1 - f_2}{2f_1 - f_0 - f_2} \times h$$

Now Mode

$$= 40 + \frac{12 - 10}{24 - 10 - 10} \times 10$$

$$= 40 + \frac{2}{4} \times 10$$

$$= 40 + 5$$

$$= 45$$

\therefore Mode = 45

$$\text{Now } \frac{N}{2} = \frac{50}{2} = 25$$

\therefore Median class is 40-50

$$= l_1 + \frac{\frac{N}{2} - c}{f} \times h$$

Now median

Here $N = 50, C = 22, F = 12, h = 10, l_1 = 40$

$$\therefore \text{Median} = l_1 + \frac{25 - 22}{12} \times 10$$

$$= 40 + \frac{1}{4} \times 10$$

$$= 40 + 2.5$$

$$= 42.5$$

Thus, Median = 42.5